# Parental rating of sleep in children with attention deficit/hyperactivity disorder

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**Abstract** *Objective* Sleep problems have often been associated with attention deficit/hyperactivity disorder (ADHD). Parents of those with ADHD and children with ADHD report sleep difficulties more frequently than healthy children and their parents. The primary objective of this paper is to describe sleep patterns and problems of 5 to 11-year-old children suffering from ADHD as described by parental reports and sleep questionnaires. *Method* The study included 321 children aged 5–11 years (average age 8.4 years); 45 were diagnosed with ADHD, 64 had other psychiatric diagnoses, and 212 were healthy. One hundred and ninety-six of the test subjects were boys and 125 were girls. A semi-structured interview (Kiddie-SADS-PL) was used to DSM-IV diagnose ADHD and comorbidity in the clinical group. Sleep difficulties were rated using a structured sleep questionnaire (Children Sleep Behaviour Scale). *Results* Children diagnosed with ADHD had a significantly increased occurrence of sleep problems. Difficulties relating to bedtime and unsettled sleep were significantly more frequent in the ADHD group than in the other groups. Children with ADHD showed prolonged sleep onset latency, but no difference was shown regarding numbers of awakenings per night and total sleep time per night. Comorbid oppositional defiant disorder appeared not to have an added effect on problematic behaviour around bedtime. *Conclusion* Parents of children with ADHD report that their children do not sleep properly more often than other parents. The ADHD group report problems with bedtime resistance, problems with sleep onset latency, unsettled sleep and nightmares more often than the control groups. It may therefore be relevant for clinicians to initiate a closer examination of those cases reporting sleep difficulties.

**Key words** sleep – attention deficit/hyperactivity disorder – sleep questionnaire

## Introduction

Sleep problems in children have often been associated with attention deficit/hyperactivity disorder (ADHD). The core symptoms of ADHD, inattention, hyperactivity and impulsiveness, are often associated with behaviour-regulation difficulties, and these emotions are strikingly similar to the difficulties caused by disrupted sleep and sleep deprivation [15]. Sleep

difficulties have even been included in the diagnostic criteria for ADHD in the DSM III [2] and are often included in ADHD rating scales, e.g. Conners' Rating Scale for parents [19].

It has been theorized that sleep deprivation in children with ADHD could be a result of a primary sleep disorder, or that it could be related to dysregulation of arousal mechanisms as implicated in the aetiology of ADHD [6]. We know that sleep difficulties with no explanatory cause can be mistaken for ADHD [25], and that the kind of symptoms observed in primary sleep disorders—such as sleep-related breathing disorders or periodic limb movement disorders—can often be mistaken for ADHD as they are very similar to ADHD core symptoms. These disorders are found to be related to hyperactivity and inattentiveness [9–11, 17, 40, 41], and the treatment of these sleep disorders has reduced—or even cured—both hyperactivity and inattentiveness [13, 47]. It has also been proposed that an unstable sleep schedule could be the result of biological immaturity or a dysfunction somehow related to inattentiveness. Likewise, it has been suggested that instability of the sleep-wake system may play a role in the irregularity of the arousal level [21].

Sleep problems are furthermore of interest because children with ADHD often have learning difficulties [4], and several studies have documented a link between sleep disorders and learning difficulties [14, 34, 35, 42, 45].

Parents of children with ADHD often report that their child has difficulty sleeping. Little need for sleep, difficulties falling asleep, restless sleep, frequent awakenings and fatigue in the morning are commonly reported problems [16, 30, 46]. The children themselves also report sleep difficulties more often than children without ADHD [38]. Self-report studies show that more than half the children with ADHD reported that they experienced sleep difficulties [5, 20, 30], which could be of great theoretical importance in the clinical work. The ADHD disorder affects approximately 3–5% of all school age children [3].

Recent studies indicate that the majority of AHDH-related sleep difficulties may result from a combination of comorbidity and medical treatment [12]. Comparing children with ADHD against clinical controls, Mick et al. [36] found no significant sleep difficulties in children with ADHD when comorbidity (anxiety, oppositional defiant disorder and depression) and treatment with stimulants were taken into account. But few studies have addressed this possible connection, and the picture so far is far from clear.

Other studies have, however, documented a higher degree of insomnia and more individual variation in time to sleep latency in stimulant free children with ADHD compared with children with other psychiatric diagnoses and healthy children. Children's sleeping behaviour is also primarily reported by parents. Studies have documented a discrepancy between parental reports on sleep difficulties and objective measurements, raising the question that parents may tend to overestimate the problem [8, 20, 26, 32, 33, 39].

It is well-documented that children's sleep difficulties are a considerable stress factor for parents [43]. One hypothesis is that children with ADHD are more liable to wake their parents during the night than non-ADHD children, making their parents more aware of any sleep difficulties [5]. This has, however, not been documented.

It is, however, still uncertain whether reported sleep difficulties in children with ADHD constitute a real sleep problem, or whether they are merely considered a problem because they are experienced as such by the parents. This distinction is important when choosing treatment. If the latter is the case, our focus must be on the parents. A possible hypothesis could be that children with ADHD experience more sleep disorders (or sleep phenomena) that are not measureable by actigraphy, and that this—along with the growing sleep pattern instability [21]—is the background for the frequently reported cases of sleep difficulties in children with ADHD.

Previous studies are weighed down by methodological issues, such as variations in inclusion criteria (ADHD assessed using standardized interviews vs. symptoms of ADHD evaluated by means of simple questionnaires), lack of control for confounding factors (such as psychiatric comorbidity) and different medication status.

## Objectives

The objective of this article is, based on parental reports and sleep questionnaires, to describe the sleep difficulties/sleep phenomena experienced by ADHD children compared to sleep experiences of children either with other psychiatric diagnoses and healthy children. The article will evaluate to what extent comorbid ODD contributes to sleep problems and whether children with ADHD are more liable to wake their parents during the night than non-ADHD children.

## Methods

### Participants

The group studied here consisted of 321 children, all between 4.4 and 12.4 years of age. One hundred and nine children referred to a children's psychiatric

clinic for attention, behavioural or other psychiatric problems were recruited on an ongoing basis.

The group of referred children was divided into a group with ADHD and a group with other psychiatric diagnoses. The psychiatric control group was used to exclude the possibility that a psychiatric diagnose itself explained problems related to sleep.

To compare sleep with healthy children, 212 children were recruited through a state school as a non-clinical reference group. They were not examined, but were excluded if they had previously been in contact with children in mental health care.

The group consisted of 196 boys and 125 girls; all were stimulant medication naïve.

Children were excluded if they suffered from major sensor-motor handicaps (blindness, deafness, and paralysis), psychosis or autism, or if they had a full-scale IQ rating below 70 based on cognitive testing.

### Diagnostic measures

All the children in the referred group were subjected to rigorous clinical diagnostic assessment based on the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV) [3]. An ADHD group and a psychiatric control group were identified.

The interview used was the "Schedule for Affective Disorders and Schizophrenia for School-aged Children—Present and Lifetime version" (K-SADS-PL) [31]. This interview also ensured that children in the psychiatric control group did not also meet the ADHD criteria. The healthy group was not clinically assessed.

To assess the nature of the sleep problems, we used the Children Sleep Behaviour Scale (CSBS), which is a standard sleep questionnaire developed by Fisher et al. [18]. The prevalence of this broad range of sleep-related behavioral characteristics of 870 children aged 6–12.5 years was originally assessed with this scale in order to develop population standards. The reliability of the test/re-test over a 2-week period was considered adequate [18].

CSBS consists of 22 items specially developed to screen a wide range of sleep-related behavioural characteristics related to primary school children. The questionnaire is completed by parents. The items are arranged in a five step Likert-type format, in which the 22 items are evaluated by parent(s). The five response options are: "never", "rarely", "occasionally", "quite often" and "often". One question regarding sleeping time has the following options: "4–5", "6–7", "8–9", "10–11" and "more than 11 h".

This provides retrospective information on sleep patterns over a 6 month period.

To estimate the subjectively experienced sleep pattern, we asked the parents to keep a sleep diary for five consecutive nights in which they noted when their child went to bed, fell asleep, any nightly awakenings (after falling asleep) and when he or she got up in the morning.

### Procedure

The questionnaire was translated into Danish, yet accurately maintained the meaning of the questions. The five response options were likewise translated accurately.

In the clinical examination groups (the ADHD group and the psychiatric control group), the questionnaire was handed to the parents after they had agreed to participate in the project. Parents were instructed to complete the questionnaire, rating the response to each question according to the term that best matched their child's behaviour within the last 6 months. The response rate in the clinical groups was 100%.

The healthy control group was recruited from a city school. The questionnaires, accompanied by a letter to serve as a guide and explanation of the study, were handed out to 298 children by a teacher in those school classes participating in the study. Three weeks after the questionnaire had been distributed in class, a reminder was sent by mail to the families who had not yet responded.

This resulted in a total response rate of 71% in the healthy group. We have no information about the group that did not return the questionnaire.

### Data analysis

A statistical analysis was performed using the SPSS for Windows version 14.0. Age difference between the groups was investigated using a one-way analysis of variance (ANOVA). Social class was analysed using Chi-square.

In Tables 2 and 3, answers were divided into three groups: "never/rarely", "occasionally" and "quite often/often".

The cut-off score for differentiating between normal and affected sleep was set as "never/rarely", and we analyzed how large a proportion of the three subgroups scored below the cut off rate.

In Table 2 we used logistic regression analysis with dichotomous dependent variables. To adjust for multiple comparisons, we used a Bonferroni adjustment.

## Results

### Subject characteristics

Demographic data is shown in Table 1.

**Table 1** Descriptive characteristics of children and parents

| | ADHD group ($n$ = 45) | Psychiatric controls ($n$ = 64) | Healthy controls ($n$ = 212) | $P$ value** |
|---|---|---|---|---|
| Age (mean) | 8.7 years | 9.1 years | 8.4 years | 0.0025* |
| (SD) | (1.28) | (1.44) | (1.26) | |
| Gender (%) | | | | |
| Boys | 37 (82.2) | 55 (85.9) | 105 (49.5) | 0.001 |
| Girls | 8 (17.8) | 9 (14.1) | 107 (51.5) | |
| Family type | | | | |
| Two-parent family[a] | 31 (68.9) | 48 (75.0%) | 176 (83.4%) | 0.052 |
| Other | 14 (31.1%) | 16 (25.0%) | 36 (17.0%) | |
| Social class[b] | | | | 0.001 |
| Self-employed (%) | 1 (2.2) | 9 (14.1) | 19 (9.0) | |
| Salary-earner (%) | 35 (77.8) | 44 (68.8) | 185 (87.2) | |
| Student (%) | 2 (4.4) | 2 (3.1) | 0 (0.0) | |
| Transfer income (%) | 5 (11.1) | 6 (9.4) | 6 (2.8) | |
| Unknown (%) | 2 (4.4) | 3 (4.7) | 2 (0.9) | |
| Psychiatric diagnoses/comorbidity (%) | | | | |
| AD/HD | 45 (100) | 0 (0) | | |
| ODD/CD | 20 (44.4) | 17 (26.6) | | |
| Emotional disorders[c] | 1 (2.2) | 15 (23.4) | | |
| Other[d] | 1 (2.2) | 32 (50.0) | | |
| Enuresis | 6 (13.3) | 7 (11.0) | 11 (5.2) | 0.087 |
| Somatic diagnoses (%) | | | | |
| Asthma | 6 (13.3) | 4 (6.3) | 18 (8.5) | 0.449 |
| Other | 0 (0) | 1 (1.6) | 3 (1.4) | 0.534 |
| Medication (%) | | | | |
| Prescribed by doctor | 8 (17.8) | 9 (14.1) | 21 (10.0) | 0.281 |
| Alternative medicine | 4 (8.9) | 2 (3.1) | 7 (3.3) | 0.206 |

* ANOVA, SPSS
** Chi-squares with two degrees of freedom
[a]Two parents in the family. Two biological parents or one biological parent and his/her cohabiting partner
[b]Social class relate to the primary care-giver of the child
[c]Emotional disorders include Affective disorder and anxiety disorders
[d]Other include Obsessive–compulsive disorder, Tourette syndrome and Specific learning disabilities

Referred families (ADHD and psychiatric controls) were evenly distributed across social classes and family types. The age span ranged from 4.4 to 12.4 years, with an average of 8 years and 11 months. There were more boys than girls. In the ADHD group, there were more one-parent families than in the other two groups, but the difference was not significant. The healthy reference group was composed of children aged from 5.11 to 11.1 years, with an average of 8 years and 5 months. We found significant difference in age, gender and social class over the three groups. These differences were adjusted for.

All children, whether referred or healthy, attended normal schools.

None of the children were prescribed stimulants, hypnotics or other medication that influences sleep. Fifty-six of the children had a paediatric diagnosis (predominantly asthma and enuresis nocturna), of which 28 (predominantly asthma) were medically treated. Thirteen of the children were treated with alternative medicine (however, none of them for ADHD or sleep disturbances).

## Sleep patterns

Table 2 shows the results of the questionnaires completed by parents. The results are shown as the number of children with problematic sleep behaviour defined as occurring often or quite often (except for questions 1, 3, 13, 16 and 19 where problematic sleep behaviour is defined when occurring never/rarely).

Table 2a and b clearly shows that the ADHD group tends to score rather poorly compared to the control groups on all criteria. It also shows that the psychiatric group tends to score better and to have fewer problems than the ADHD group, and that the healthy control group has altogether fewer sleeping problems than either of the clinical groups.

The differences are significant for items 1, 2, 5, 10, 14, 16–18, 20 even after adjustment for multiple comparisons. Of particular interest are the items relating to conditions around bedtime and sleep latency time (or sleep onset latency) (items 1, 13, 15 and 20) and to unsettled sleep (items 2, 4, 6 and 7). The

**Table 2** Parent-estimated sleep-related behaviours by diagnosis

| Item | ADHD group ($n$ = 45) Often/quite often (never/rarely)[a] Number (%) | Clinical controls ($n$ = 64) Often/quite often (never/rarely)[a] Number (%) | Healthy controls ($n$ = 212) Often/quite often (never/rarely)[a] Number (%) |
|---|---|---|---|
| a. Percent of children with parent-estimated sleep behaviour during the past 6 months scoring quite often/often (never/rarely) (descriptive figures)[a] | | | |
| 1. Does your child go to bed willingly?[a] | 14 (31.1) | 10 (15.9) | 15 (7.1) |
| 2. Is he/she a restless sleeper? | 15 (33.3) | 11 (17.5) | 18 (8.5) |
| 3. Have you seen your child smiling while asleep?[a] | 29 (64.4) | 37 (57.8) | 98 (46.4) |
| 4. Does he/she wake up during the night? | 12 (26.7) | 5 (7.9) | 25 (11.9) |
| 5. Have you heard your child talking in his/her sleep? | 15 (33.3) | 7 (11.1) | 28 (13.2) |
| 6. Have you observed him/her sleep-walking? | 5 (11.1) | 0 (0.0) | 4 (1.9) |
| 7. While asleep does he/she ever sit up in bed? | 4 (8.9) | 0 (0.0) | 1 (0.5) |
| 8. Does he/she grind his/her teeth while asleep? | 13 (28.9) | 8 (12.7) | 12 (5.7) |
| 9. Have you heard your child laughing in his/her sleep? | 3 (6.7) | 0 (0.0) | 6 (2.9) |
| 10. Has your child told you about having a frightening dream? | 17 (37.8) | 9 (14.3) | 16 (7.5) |
| 11. Have you observed repetitive actions such as rocking or head banging while your child is asleep? | 2 (4.4) | 3 (4.8) | 3 (1.4) |
| 12. Does he/she have problems with bed-wetting? | 5 (11.1) | 7 (11.1) | 8 (3.7) |
| 13. Does your child fall asleep easily?[a] | 10 (22.2) | 5 (7.9) | 16 (7.6) |
| 14. Have you seen or heard your child having nightmares which he/she did not remember the next day? | 6 (13.3) | 1 (1.6) | 3 (1.4) |
| 15. Has he/she expressed fear of sleeping in the dark? | 17 (37.8) | 22 (34.9) | 41 (19.4) |
| 16. Is your child easy to wake up in the morning?[a] | 11 (24.4) | 8 (12.7) | 11 (5.2) |
| 17. Have you observed your child having a nightmare during which he/she appeared extremely afraid or terrified? | 6 (13.3) | 2 (3.2) | 3 (1.4) |
| 18. Have you looked in on your child and discovered that he/she was crying while asleep? | 2 (4.4) | 1 (1.6) | 1 (0.5) |
| 19. Has he/she told you about having pleasant dreams?[a] | 24 (53.3) | 28 (44.4) | 73 (34.6) |
| 20. Does your child complain about difficulties going to sleep? | 14 (31.1) | 6 (9.5) | 11 (4.9) |
| 21. Does he/she get up to go to the bathroom during the night? | 10 (22.2) | 7 (11.1) | 23 (10.9) |

| | Coeff. | SE | *P* value¤ | 95% conf. interval |
|---|---|---|---|---|
| b. ADHD ($n$ = 45) and clinical controls ($n$ = 64) compared to healthy controls ($n$ = 212) | | | | |
| 1. Does your child go to bed willingly? | | | | |
| ADHD | 1.64 | 0.44 | *0.000* | 0.78–2.50 |
| Clinical controls | 0.77 | 0.47 | 0.097 | −0.14–1.68 |
| 2. Is he/she a restless sleeper? | | | | |
| ADHD | 1.62 | 0.42 | *0.000* | 0 .79–2.45 |
| Clinical controls | 0.73 | 0.45 | 0.104 | −0.15–1.60 |
| 3. Have you seen your child smiling while asleep? | | | | |
| ADHD | 0.76 | 0.35 | 0.031 | 0.07–1.45 |
| Clinical controls | 0.49 | 0.31 | 0.114 | −0.12–1.10 |
| 4. Does he/she wake up during the night? | | | | |
| ADHD | 0.81 | 0.42 | 0.051 | 0.00–1.63 |
| Clinical controls | −0.59 | 0.53 | 0.267 | −1.64–0.45 |
| 5. Have you heard your child talking in his/her sleep? | | | | |
| ADHD | 1.24 | 0.40 | *0.002* | 0.45–2.03 |
| Clinical controls | −0.20 | 0.48 | 0.686 | −1.14–0.75 |
| 6. Have you observed him/her sleep-walking? | | | | |
| ADHD | 2.48 | 0.83 | 0.003 | 0.85–4.12 |
| Clinical controls | | | | |
| 7. While asleep does he/she ever sit up in bed? | | | | |
| ADHD | 2.91 | 1.18 | 0.014 | 0.59–5.23 |
| Clinical controls | | | | |
| 8. Does he/she grind his/her teeth while asleep? | | | | |
| ADHD | 1.96 | 0.47 | *0.000* | 1.03–2.89 |
| Clinical controls | 0.97 | 0.52 | 0.062 | −0.05–1.98 |
| 9. Have you heard your child laughing in his/her sleep? | | | | |
| ADHD | 1.23 | 0.81 | 0.127 | −0.35–2.81 |
| Clinical controls | | | | |

**Table 2** Continued

| | Coeff. | SE | *P* value¤ | 95% conf. interval |
|---|---|---|---|---|
| 10. Has your child told you about having a frightening dream? | | | | |
| ADHD | 2.04 | 0.47 | *0.000* | 1.19–2.90 |
| Clinical controls | 0.67 | 0.49 | 0.169 | −0.28–1.62 |
| 11. Have you observed repetitive actions such as rocking or head banging while your child is asleep? | | | | |
| ADHD | 1.55 | 1.06 | 0.144 | −0.53–3.64 |
| Clinical controls | 1.59 | 1.01 | 0.115 | −0.39–3.56 |
| 12. Does he/she have problems with bed-wetting? | | | | |
| ADHD | 0.99 | 0.62 | 0.112 | −0.23–2.20 |
| Clinical controls | 1.08 | 0.57 | 0.060 | −0.05–2.21 |
| 13. Does your child fall asleep easily? | | | | |
| ADHD | 1.25 | 0.47 | 0.008 | 0.32–2.17 |
| Clinical controls | 0.04 | 0.57 | 0.940 | −1.07–1.16 |
| 14. Have you seen or heard your child having nightmares which he/she did not remember the next day? | | | | |
| ADHD | 3.19 | 0.91 | *0.000* | 1.40–4.97 |
| Clinical controls | 0.97 | 1.28 | 0.448 | −1.54–3.49 |
| 15. Has he/she expressed fear of sleeping in the dark? | | | | |
| ADHD | 0.98 | 0.37 | 0.008 | 0.25–1.71 |
| Clinical controls | 0.85 | 0.34 | 0.014 | 0.18–1.53 |
| 16. Is your child easy to wake up in the morning? | | | | |
| ADHD | 1.71 | 0.49 | *0.000* | 0.75–2.68 |
| Clinical controls | 0.88 | 0.53 | 0.096 | −0.15–1.91 |
| 17. Have you observed your child having a nightmare during which he/she appeared extremely afraid or terrified? | | | | |
| ADHD | 2.83 | 0.89 | *0.001* | 1.09–0.57 |
| Clinical controls | 0.24 | 1.07 | 0.249 | −0.87–3.34 |
| 18. Have you looked in on your child and discovered that he/she was crying while asleep? | | | | |
| ADHD | 17.63 | 4.17 | *0.000* | 9.46–25.80 |
| Clinical controls | 16.53 | 4.47 | *0.000* | 7.77–25.29 |
| 19. Has he/she told you about having pleasant dreams?[a] | | | | |
| ADHD | 0.74 | 0.35 | 0.032 | 0.06–1.42 |
| Clinical controls | 0.43 | 0.31 | 0.169 | −0.18–1.05 |
| 20. Does your child complain about difficulties going to sleep? | | | | |
| ADHD | 2.31 | 0.51 | *0.000* | 1.32–3.31 |
| Clinical controls | 0.64 | 0.60 | 0.286 | −0.54–1.82 |
| 21. Does he/she get up to go to the bathroom during the night? | | | | |
| ADHD | 1.02 | 0.45 | 0.024 | 0.13–1.91 |
| Clinical controls | 0.15 | 0.50 | 0.765 | −0.83–1.13 |

Items 1, 2, 5, 8, 10, 14, 16, 17, 18, 20 survive an adjustment for multiple comparisons in a Bonferroni adjustment (0.05/21 = 0.002), comparing ADHD and healthy controls

¤ *P* value adjusted for age, gender and social class

[a]Problematic behaviour is scored never/rarely in items 1, 3, 13, 16 and 19

ADHD group has a significantly lower score in these areas. The results for item 16, morning tiredness, are also significant as ADHD children seem to have more difficulties than the other groups.

One-third of the children with ADHD are often or very often unwilling to go to bed. One-third of the children complain to their parents that they find it hard to fall asleep, while only one-fifth of the ADHD children are assessed by the parents as having difficulties falling asleep. One-third of the children with ADHD are reported to suffer from unsettled sleep, while a quarter of them often wake up during the night.

Another frequently reported problem is that 13.3% of all ADHD children have nightmares, compared with only 1.4% of healthy children. The percentage of children complaining (to parents) of frightening dreams is, however, somewhat higher here: 37.8% of ADHD children and 7.5% of healthy children.

When taking into account the possible co-existence of comorbid ODD and ADHD, we find—as shown in Table 3—that children with ADHD and comorbid ODD had more problems relating to bedtime (items 1, 13 and 20) and wake up time (item 16), but the findings were not significant.

Comorbid ODD seems to have some impact on the fear of falling asleep in the dark.

When completing a sleep diary for 5 days, parents of children with ADHD seem to estimate sleep onset latency (time between parents noting lights out and parents noting first sleep onset), as significantly longer than those in the healthy control groups. However, children with ADHD do not tend to wake their parents more often than other children, and the parent rating of the child's total amount of sleep (or

**Table 3** Sleep-related behaviour around bedtime and wake-up time, comparing ADHD with and without oppositional defiant disorder (ODD) behaviour

| Item | ADHD without ODD ($n$ = 25) Often/quite often (never/rarely) Number (%) | ADHD with ODD (n = 20) Often/quite often (never/rarely) Number (%) | $P$ value* |
|---|---|---|---|
| 1. Does your child go to bed willingly?[a] | 7 (28.0) | 7 (35.0) | 0.614 |
| 13. Does your child fall asleep easily?[a] | 3 (12.0) | 7 (35.0) | 0.065 |
| 15. Has he/she expressed fear of sleeping in the dark? | 5 (20.0) | 12 (60.0) | <0.01 |
| 16. Is your child easy to wake up in the morning?[a] | 5 (20.0) | 6 (30.0) | 0.438 |
| 20. Does your child complain about difficulties going to sleep? | 5 (20.0) | 9 (45.0) | 0.072 |

* Chi-squares with one degree of freedom
[a]Problematic behaviour when scored never/rarely

**Table 4** Parent-reported sleep onset latency, numbers of awakenings and total sleep time. Estimated from parent-completed 5-day sleep diary

| | ADHD group ($n$ = 45) | Psychiatric controls ($n$ = 64) | Healthy controls ($n$ = 212) | $P$ value* |
|---|---|---|---|---|
| Sleep onset latency minutes (SD) | 44.3 (21.4) | 34.3 (15.3) | 24.8 (11.1) | 0.001¤ |
| Numbers of awakenings per night (SD) | 0.27 (0.37) | 0.17 (0.25) | 0.24 (0.35) | 0.568 |
| Total sleep time per night minutes per night (SD) | 600 (64.5) | 577.3 (118.9) | 621.6 (69.6) | 0.339 |

*SD* standard deviation
* Kruskal–Wallis Test, analyses adjusted for gender, age and social class
¤ADHD compared with Healthy controls $P$ = 0.001, clinical controls compared with healthy controls $P$ = 0.031 (regression analysis)

time spent in bed) is the same in all three groups (Table 4).

## Discussion

Parents of children with ADHD report sleep difficulties in their child [16, 30, 46] more frequently than parents of healthy children. Also, self-reported sleep difficulties are more frequent for ADHD children than for others [38].

Like Wiggs et al. [48], we also found that parents of children with ADHD experienced more difficulties related with bedtime than parents of healthy children.

Problems around bedtime (unwillingness to go to bed and difficulties falling asleep) are often or very often a problem with 49% of the children in the ADHD group, compared with 14% of the healthy control group. This agrees with O'Brien et al. [37]. They found that 77% of ADHD children had problems with bedtime and experienced unsettled sleep compared with only 43% within the healthy control group.

Our study shows that 31% of the ADHD children were often or very often unwilling to go to bed; 22% are rated (by their parents) as having difficulty falling asleep, while 31% of the children complain (according to parents) of difficulties falling asleep. These figures agree with other studies that report 20–27% of children with ADHD are unwilling to go to bed, and between 11 and 42% have sleep onset latency problems [7, 44].

In the ADHD group, 13.3% of the children had nightmares, compared with only 1.4% of the healthy control group. 37.8% of children with ADHD reported having scary dreams, compared to 7.5% of healthy children. Hoeppner et al. [24] finds that 16% of parents with ADHD children frequently observed that their children had nightmares, compared with only 3% of the healthy group. The findings of our study therefore corroborate other previous works.

Reported difficulties relating to bedtime can be hard to verify objectively. Several studies have pointed to discrepancies between objective measurements and parental reports [26, 32, 33, 48], and it seems possible that the higher incidence of parentally reported sleep disturbances compared to those objectively measured, may be explained by behavioural or family related conditions. Likewise, Blader et al. [7] found that increased unwillingness to go to bed was related to varying bedtimes and falling asleep out of bed. Also, tiredness and unease in parents may be transmitted to the child [29] and, consequently, disturb the child's sleep.

Some studies have argued that the frequent discrepancy between subjective and objective findings may result from the fact that some children "may not be signallers" of night waking and therefore not necessarily alert their parents about difficulties maintaining sleep [28].

It is interesting to see that 26% of parents of ADHD children assesses that their child often or very often wakes up during the night. This is significantly more

than in the control groups. However, there was no difference in the number of awakenings when parents reported the incidents night by night (sleep diary). Therefore, this finding does not support the aforementioned theory.

Some studies [12, 36] argue that comorbid behavioural disorder (oppositional defiant disorder, ODD) may serve as an explanation for sleep disorder, or at least for settling problems. This, however, cannot be confirmed. Unsettled sleep, awakenings during the night, fear of the dark and nightmares were seen more often in the group with ADHD and comorbid ODD, but there was no connection between comorbid ODD and problems related to bedtime.

Findings in a previous study [21] document increased instability in the sleep pattern of children with ADHD. Added to the study's findings of increased problems with parasomnia (sleepwalking, sleep talking, etc.), with no relation to bedtime behaviour, it may suggest that we could be dealing with real sleeping difficulties and not merely the experiences of overstretched parents. Other studies have found that parents are indeed able to differentiate between simple unwillingness to go to bed and occurrence of serious difficulties connected to falling asleep [7].

Consequently, the main conclusion of this study can be summarized as follows: the study shows that parents of stimulant free children with ADHD report sleep difficulties in their children more frequently than parents of children with other psychiatric diagnoses and healthy children.

We did not find comorbid ODD to be related to problematic bedtime settling, and the results cannot be explained exclusively by the fact that the parents over-report difficulties. Nor did children with ADHD wake their parents during the night more often than are non-ADHD children.

In the ADHD group, conditions regarding bedtime, sleep initiation and unsettled sleep are problem areas of particular concern.

Sleep disturbances should be viewed as a complicating factor in children with ADHD. Therefore, it is of the utmost importance that clinicians, in every single case, have a good sleep anamnesis. However, parents tend to over-report the occurrence of sleep problems and base their reports on isolated bad nights. It would therefore be a good idea to combine sleep investigations based on questionnaires and sleep diary with objective measurements, such as actigraphy. This is likely to give a more detailed picture of the actual sleep pattern.

The strengths of this study are that the diagnosis of ADHD was based on standardized semi-structured interviews, that patients with ADHD were stimulant naive, and that we were able to compare sleep in children with ADHD to children with other psychiatric diagnoses and healthy children.

## Limitations

The questionnaire does not define any specific number of occurrences for scores. Whether the three study groups have different views on how many times in 6 months an occurrence must occur to score "rarely", "sometimes", "quite often" or "often" is unknown. If such differences do exist, it is likely to have impact on the findings. Furthermore, this study was not able to provide any information regarding symptoms of breathing problems (SBD) or restless leg syndrome. The symptoms of primary sleep diseases, such as SBD, can in some cases appear very similar to those of ADHD, and treatment of SBD can diminish or cure ADHD symptoms [1, 9, 11, 22, 23].

The study does not ask the parents whether they view their child's sleep difficulty as a sleep disorder. It only registers the evaluation of each question. Therefore, we do not know whether the three groups require exactly the same amount of registered "sleep problem symptoms" to classify the case as a sleep disorder.

We have not registered any possible psychiatric symptoms or ADHD-like behaviour in the healthy control group. This has probably no relevance for the findings, as the tendency in the study has clearly been that children with psychiatric symptoms have more sleep difficulties than healthy children, and that ADHD children have even more sleep difficulties than those with psychiatric problems. However, we know that some of the healthy children may only appear healthy because they have not been tested for psychiatric symptoms. Had we had done that, and excluded the children with psychiatric or ADHD-similar symptoms, it would probably have made the sleep patterns of the healthy group appear better, i.e., even fewer sleep difficulties, and the difference between the healthy and the ADHD group would consequently have been greater.

Previous studies have used different questionnaires, which makes direct comparison between examinations difficult. The healthy control group's responses to this study are, however, in reasonable agreement with previous studies of healthy populations [18]—despite the fact that other studies [27] have pointed out extensive differences for otherwise comparable countries.

Finally, the lack of significance in Table 3 may be related to the small sample size in the two groups.

As far as we know, this study is one of the most extensive of its kind comparing ADHD children both with children with other psychiatric symptoms as well

as healthy children. However, more investigations are required if the aforementioned findings are to be confirmed, just as the implication of treatment with stimulants ought to be examined in detail.

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